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392-435 AU 216 45C04

GB 0635233
APR 1950

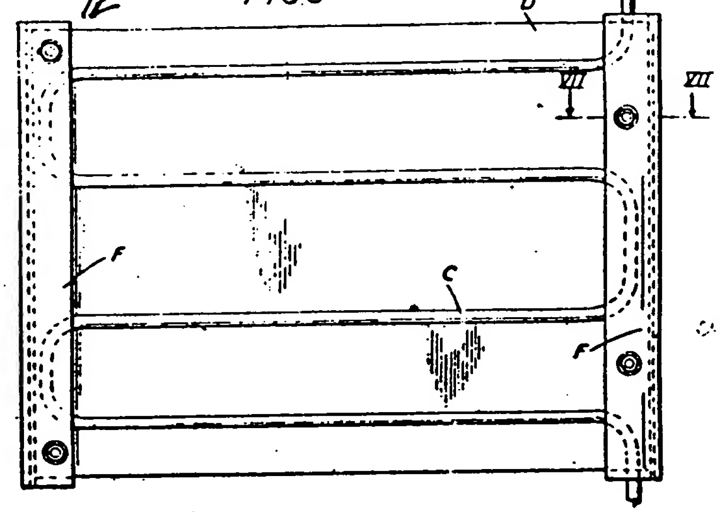
219/345 (T 392/435 Welded or Brazed) 652233

3 SHEETS

SHEET 2 SHEET 3

clamps to hold H.U.

FIG.6



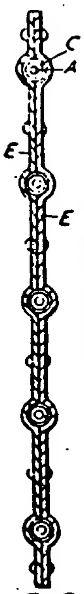
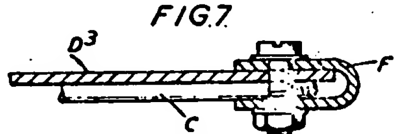


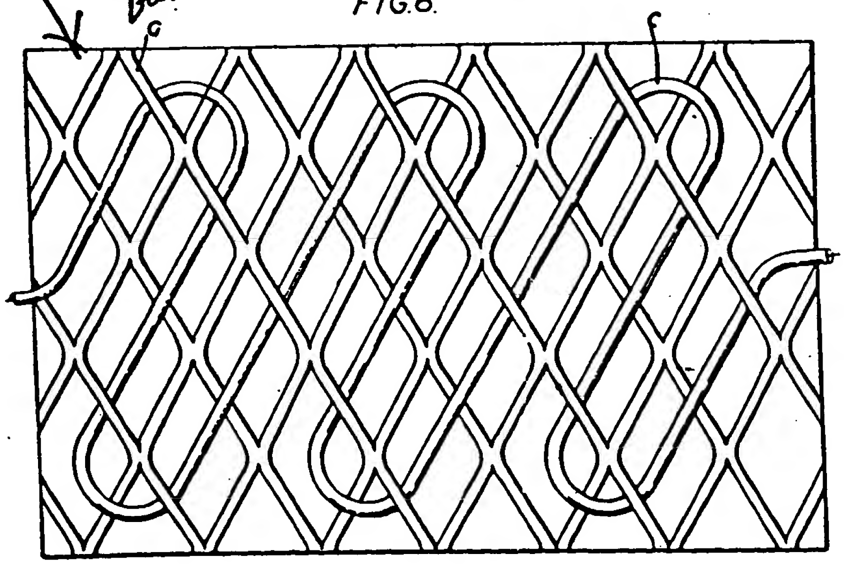
FIG.5

FIG.7



expanded wire panel

FIG.8



219 - [illegible]

635233

635,233 COMPLETE SPECIFICATION

345
355

[This Drawing is a reproduction of the Original on a reduced scale.]

FIG3

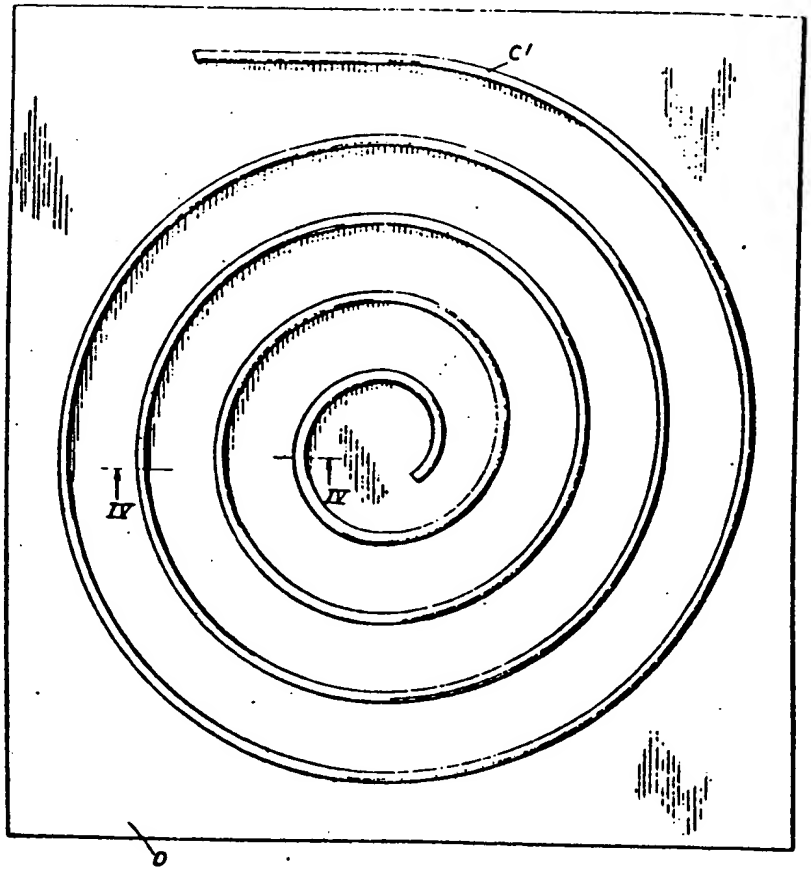
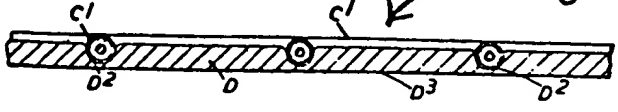


FIG.4.



press fitted in grooves

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3 SHEETS
SHEET 1

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soldered or brazed

FIG 2

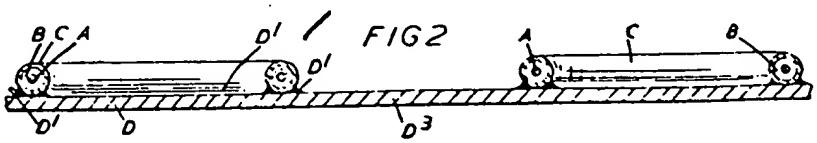
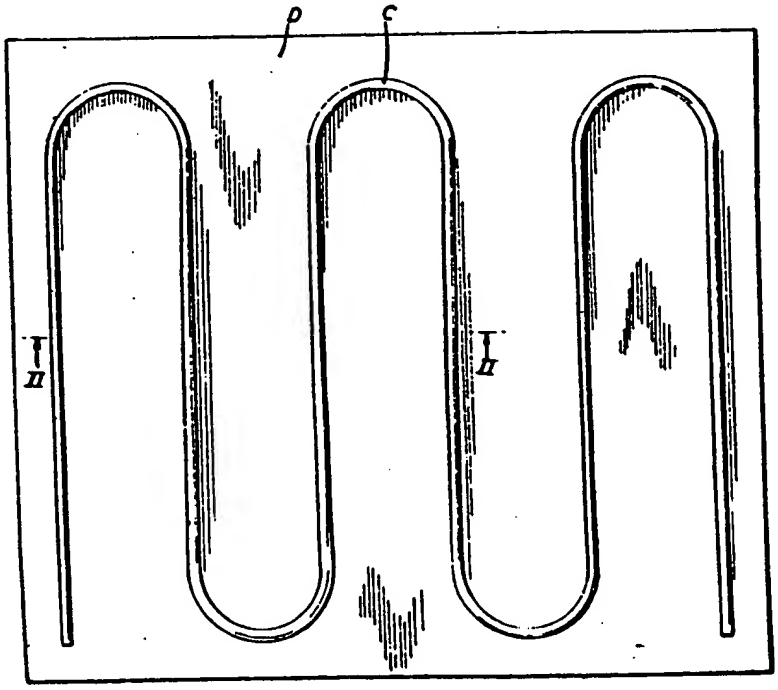


FIG. 1.



H.M.S.O.(Ty. P.)

PATENT SPECIFICATION

635,233

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PROVISIONAL SPECIFICATION.

Improvements in or relating to Electrical Heaters.

We, PYROTENAX LIMITED, a Company registered under the Laws of Great Britain, of Hedgeley Road, Hebburn-on-Tyne, in the County of Durham, GEORGE DONALD CLOTHIER, British Subject, of "Gables," 192, Hollywood Avenue, Gosforth, Newcastle-on-Tyne, 3, and RALPH FENWICK, British Subject, of "Stressa," 7, Graham Park Road, Gosforth, Newcastle-on-Tyne, 3, do hereby declare the nature of this invention to be as follows :—

This invention relates to electric heaters of the so-called "low-temperature" type wherein the heat is transferred from the small superficial surface of an electric heating element to a relatively large dissipating surface which disseminates the heat at low temperature to the surrounding medium such for example as air or other fluid.

With ordinary heating elements, it is difficult to transfer the heat uniformly and economically to the heat dissipating surface (e.g. a radiator panel) without the use of a convecting medium such as oil, water or enclosed air. Low-temperature heaters of the tubular type employ air as the convecting medium, or the conducting properties of refractory materials, but though the enclosing tube is convenient for enclosing the live element and supporting its insulators, the range of use of such heaters is to some extent limited by reason of their shape.

In an electric heater of the type referred to above and according to the present invention, the heating element is constituted by a resistance wire disposed within and electrically insulated from a metal sheath, the heating element being arranged with the sheath in good heat conducting contact with a heat dissipating plate, grid or other wall of good heat conducting material and whose superficial area exceeds that of the sheath. The heat is thus transferred from the resistance wire to the sheath and thence to the relatively large heat dissipating surface from which the heat is dissipated to the medium which is to be heated.

The resistance wire is preferably insulated from the sheath by pulverised mineral insulating material, such for example as magnesia, the heating element (i.e. the resistance wire and sheath) being arranged on the heat dissipating surface in the form of a plurality of mutually spaced lines, convolutions, coils or the like so as to form a grid extending over a large surface of the heat dissipating wall. The mutual spacing of successive lines, convolutions or coils of the heating element may either be such that the heat is applied uniformly, or according to a predetermined distribution, from the sheath to the heat dissipating wall.

The heat dissipating wall is preferably of metal, with the sheath soldered or brazed throughout its length, or at intervals, to the heat dissipating wall. The heating element may be disposed within a recess or recesses in the heat dissipating wall, or the heating element may be clamped to the heat dissipating wall or may be arranged between two sheets or walls at least one of which constitutes the heat dissipating wall. According to a modified construction the heat dissipating wall is in the form of a metallic grid or net into which the heating element is preferably woven.

The invention may be carried into practice in various ways but according to one arrangement the resistance wire is embedded, without spiralling, in magnesium oxide insulation which insulates the resistance wire from a surrounding metallic sheath. The insulation and sheath (which may be of copper) may be applied to the resistance wire by drawing in the well-known manner so that the resistance wire is fabricated into the sheath whose

[Price 2/-]

final diameter is very small relatively to the length of the heating element as a whole. This heating element is now laid on one face of a heat dissipating plate or wall which is of good heat conducting material, e.g. brass, the heating element being arranged in the form of a rectangular, sinusoidal or other grid on the surface of the said plate. According to a modification the heating element may be laid on the heat dissipating plate in the form of a spiral or coil. Having laid the heating element on the heat dissipating plate, the sheath is soldered or brazed throughout its length, or at frequent intervals, to the metal plate so that the lines, convolutions or coils of the heating element (whose sheath is suitably earthed) are not only in good electrical contact with the heat dissipating plate or wall but also extend over a large superficial area thereof. The mutual spacing between successive lines, convolutions or coils of the heating element may be such that the heat is transferred from the sheath, uniformly or according to a predetermined grading or distribution, over the whole of the heat dissipating surface, thus reducing the heat conducting capacity required of the material to maintain a uniform temperature of the heat dissipating surface. Normally the heating element is distributed uniformly (or graded) over the back or other hidden part of the heat dissipating plate or wall, the smooth front face of this plate being bent to match other decorations when the heater is used as a radiator. The low temperature and freedom from hot spots will preclude scorching or other damage to paint. The small external diameter of the sheath coupled with the small thickness of the surface material permitted by the length of the heating element results in an economical heater and, moreover, permits formation of the heater in any desired shape. For example, the heat dissipating wall may be in the form of a flat metallic sheet which can be attached to walls or ceilings of rooms and can be bent to traverse corners and buttresses. Further, the heat dissipating wall may be beaded, ribbed or corrugated to impart stiffness for making self-supporting units to stand on the floor or which are to be attached to walls and structures. If desired, the heat dissipating wall may be in the form of a rigid strip or bar for the purpose of manufacturing a single or multi-strip convection heater.

Instead of soldering or brazing the sheath of the heating element to the heat dissipating wall, the sheath may be attached by arranging it in a recess or recesses formed in the surface of the heat dissipating wall. According to one such arrangement the heating element is pressed into the surface of the heat dissipating wall so as to form its own recess or recesses therein. According to a modification the heating element is clamped between two plates or sheets one or each of which constitutes the heat dissipating wall. In some instances it may prove satisfactory simply to clamp the heating element by means of clips or clamps to one surface of the heat dissipating wall or plate, the clamps being arranged so as to ensure that a maximum area of the sheath is maintained in contact with the plate.

Instead of the heat dissipating wall being in the form of a sheet or plate, it may be in the form of a grid or net, e.g. expanded metal or wire netting. With this arrangement the heating element may be woven into the grid or net and the whole assembly dipped into a tinning or galvanising bath in order to ensure good heat conducting contact between the heating element and the strands of the grid or net. This construction is particularly suitable for heating gases or liquids or for embedding in a solid, such for example as plaster or cement constituting part of a ceiling or floor, the grid or net then at the same time serving also as a key for the plaster and/or as a reinforcement.

It will be understood that the constructions described above are given by way of example only. For example, the sheath of the heating element may be attached directly to a wall or walls of a metal tank, a copper boiler or other heating containers, the invention having the advantage of greatly increasing the area of the heat dissipating surface relatively to the superficial area of the heating element.

It will be apparent that the invention obviates the necessity for enclosing the heating element as in the cases of tubular low-temperature heaters though it will be appreciated that the heating element may, if desired, be applied to the inner surfaces of heat dissipating tubes. The element itself is applicable to any form of heating apparatus and to all shapes of heat dissipating surface by simple means, such for example as brazing, soldering or clamping.

Dated this 27th day of January, 1947.

PULLINGER & MALET,
Agents for the Applicants.

COMPLETE SPECIFICATION.

Improvements in or relating to Electrical Heaters.

We, PYROTENAX LIMITED, a Company registered under the Laws of Great Britain, of Hedgeley Road, Hebburn-on-Tyne, in the County of Durham, GEORGE DONALD CLOTHIER, British Subject, of "Gables," 192, Hollywood Avenue, Gosforth, New-

castle-on-Tyne, 3, and RALPH FENWICK, British Subject, of "Stressa," 7, Graham Park Road, Gosforth, Newcastle-on-Tyne, 3, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to electric heaters of the so-called "low-temperature" type wherein the heat is transferred from the small superficial surface of an electric heating element to a relatively large dissipating surface which disseminates the heat at low temperature to the surrounding medium such for example as air or other fluid.

With ordinary heating elements, it is difficult to transfer the heat uniformly and economically to the heat dissipating surface (e.g. a radiator panel) without the use of a convecting medium such as oil, water or enclosed air. Low-temperature heaters of the tubular type employ air as the convecting medium, or the conducting properties of refractory materials, but though the enclosing tube is convenient for enclosing the live element and supporting its insulators, the range of use of such heaters is to some extent limited by reason of their shape.

An electric heater of the type referred to above and according to the present invention, comprises a heating element constituted by a non-helical resistance wire core disposed within and electrically insulated from a metal sheath by pulverulent insulating material, the core, insulation and sheath having been simultaneously drawn down by mechanical working to the desired dimensions, and a heat dissipating supporting plate, grid or other wall of good heat-conducting material which carries the heating element with the sheath in intimate heat-conducting contact with the heat dissipating plate whose superficial area exceeds that of the sheath. The heat is thus transferred from the resistance wire core to the sheath and thence to the relatively large heat dissipating surface from which the heat is dissipated to the medium which is to be heated.

The resistance wire is preferably insulated from the sheath by mineral insulating material, such for example as magnesia, the heating element (i.e. the resistance wire core and sheath) being arranged on the heat dissipating surface in the form of a plurality of mutually spaced lines, convolutions, coils or the like so as to form a grid extending over a large surface of the heat dissipating wall. The mutual spacing of successive lines, convolutions or coils of the heating element may either be such that the heat is applied uniformly, or according to a predetermined distribution, from the sheath to the heat dissipating wall.

The heat dissipating wall is preferably of metal with the sheath soldered or brazed throughout its length, or at intervals, to the heat dissipating wall. The heating element may be disposed within a recess in the heat dissipating wall, or the heating element may be clamped to the heat dissipating wall or may be arranged between two sheets or walls at least one of which constitutes the heat dissipating wall. According to a modified construction the heat dissipating wall is in the form of a metallic grid or net into which the heating element is preferably woven.

The invention may be carried into practice in various ways but some convenient practical arrangements, each according to the invention, are shown by way of example in the accompanying drawings, in which

Figure 1 is a back view of one construction,

Figure 2 is a section on the line II-II of Figure 1 but on an enlarged scale,

Figure 3 is a view similar to that of Figure 1 but of a modified construction,

Figure 4 is a section on the line IV-IV of Figure 3 but on an enlarged scale,

Figure 5 shows another arrangement in section,

Figure 6 is a modification of the construction according to Figure 1,

Figure 7 is a section on the line VI-VI of Figure 6 but on a larger scale, and

Figure 8 illustrates yet a further modified construction.

In the construction shown in Figures 1 and 2 the resistance wire A is embedded, without spiralling, in magnesium oxide insulation B which insulates the resistance wire from a surrounding metallic sheath C. The insulation B and sheath C (which may be of copper) are applied to the resistance wire by drawing in the well-known manner so that the wire A, insulation B and sheath C are drawn down simultaneously to the desired dimensions. The resistance wire A is thus fabricated into the sheath C whose final diameter is very small relatively to the length of the heating element as a whole. This heating element is now laid on one face of a heat dissipating supporting plate or wall D which is of good heat conducting material, e.g. brass, the heating element being arranged in the form of a grid on the surface of the said plate D as shown in Figure 1. According to the modification shown in Figure 3, the heating element C^1 is laid on the heat dissipating plate D in the form of a spiral or coil.

Having laid the heating element on the heat dissipating plate D, the sheath C or C^1 is soldered or brazed throughout its length, or at frequent intervals, e.g. as shown at D^1 in Figure 2, to the metal plate D so that the lines or convolutions of the heating element (whose sheath C or C^1 is suitably earthed)

are not only in good electrical contact with the heat dissipating plate or wall D but also extend over a large superficial area thereof. The mutual spacing between successive lines or convolutions of the heating element may be such that the heat is transferred from the sheath C, uniformly or according to a predetermined grading or distribution, over the whole of the heat dissipating surface D, thus reducing the heat conducting capacity required of the material to maintain a uniform temperature of the heat dissipating surface D. Normally the heating element is distributed uniformly (or graded) over the back or other hidden part of the heat dissipating plate or wall D, the smooth front face D^3 of this plate being bent to match other decorations when the heater is used as a radiator. The low temperature and freedom from hot spots will preclude scorching or other damage to paint.

The small external diameter of the sheath C or C^1 coupled with the small thickness of the surface material permitted by the length of the heating element results in an economical heater and, moreover, permits formation of the heater in any desired shape. For example, the heat dissipating wall D may be as shown, that is to say in the form of a flat metallic sheet which can be attached to walls or ceilings of rooms and can be bent to traverse corners and buttresses. Further, the heat dissipating wall may be beaded, ribbed, or corrugated to impart stiffness for making self-supporting units to stand on the floor or which are to be attached to walls and structures. If desired, the heat dissipating wall may be in the form of a rigid strip or bar for the purpose of manufacturing a single or multi-strip convection heater.

Instead of soldering or brazing the sheath C or C^1 of the heating element to the heat dissipating wall D, the sheath may be attached by arranging it in a recess or recesses formed in the surface of the heat dissipating wall D. According to Figure 4 the heating element is pressed into the surface of the heat dissipating wall D so as to form its own recess or recesses D^2 therein. According to the modification shown in Figure 5, the heating element C is clamped between two plates or sheets E one or each of which constitutes the heat dissipating wall. In some instances, for example as shown in Figures 6 and 7, it may prove satisfactory simply to clamp the heating element C by means of clips or clamps F to the back surface of the heat dissipating wall or plate D, the clamps F being arranged so as to ensure that a maximum area of the sheath is maintained in contact with the plate D.

Instead of the heat dissipating wall being in the form of a sheet or plate, it may be in the form of a grid or net, e.g. expanded metal or wire netting G as shown in Figure 8. With this arrangement the heating element C may be woven into the grid or net G and the whole assembly dipped into a tinning or galvanising bath in order to ensure good heat contact between the heating element and the strands of the grid or net. This construction is particularly suitable for heating gases or liquids or for embedding in a solid, such for example as plaster or cement constituting part of a ceiling or floor, the grid or net G then at the same time serving also as a key for the plaster and/or as a reinforcement.

It will be understood that the constructions described above are given by way of example only. For example, the sheath of the heating element may be attached directly to a wall or walls of a metal tank, a copper boiler or other heating containers, the invention having the advantage of greatly increasing the area of the heat dissipating surface relatively to the superficial area of the heating element.

It will be apparent that the invention obviates the necessity for enclosing the heating element as in the cases of tubular low-temperature heaters though it will be appreciated that the heating element may, if desired, be applied to the inner surfaces of heat dissipating tubes. The element itself is applicable to any form of heating apparatus and to all shapes of heat dissipating surface by simple means, such for example as brazing, soldering or clamping.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. An electric heater of the type set forth, comprising a heating element constituted by a non-helical resistance wire core disposed within and electrically insulated from a metallic sheath by pulverulent insulating material, the core, insulation and sheath having been simultaneously drawn down by mechanical working to the desired dimensions, and a heat-dissipating supporting plate, grid or other wall of good heat-conducting material, which carries the heating element with the sheath in intimate heat-conducting contact with the heat-dissipating plate whose superficial area exceeds that of the sheath.

2. An electric heater as claimed in Claim 1, in which the resistance wire is insulated from the sheath by mineral insulating material, such for example as magnesia.

3. An electric heater as claimed in Claim 1, or Claim 2, in which the heating element is arranged in the form of a plurality of mutually spaced lines, convolutions, coils or the like so as to form a grid extending over a large surface of the heat-dissipating wall.

4. An electric heater as claimed in Claim 3, in which the mutual spacing of successive lines, convolutions or coils of the heating element is such that the heat is applied

uniformly, or according to a predetermined distribution, from the sheath to the heat-dissipating wall.

5. An electric heater as claimed in any of the preceding claims, in which the heat-dissipating wall is of metal and the sheath is soldered or brazed throughout its length, or at intervals, to the heat-dissipating wall.

6. An electric heater as claimed in any of Claims 1 to 4, in which the heating element is disposed within a recess or recesses in the heat dissipating wall.

7. An electric heater as claimed in any of Claims 1 to 4, in which the heating element is clamped between two sheets or walls one or each of which constitutes the heat dissipating wall.

8. An electric heater as claimed in any of the preceding claims, in which the heat dissipating wall is in the form of a metallic grid or net.

9. An electric heater as claimed in Claim 8, in which the heating element is woven into the net or grid.

10. An electric heater substantially as described with reference to Figures 1 and 2, or Figures 3 and 4 or Figure 5, or Figures 6 and 7, or Figure 8 of the accompanying drawings.

Dated this 13th day of January, 1948.

PULLINGER & MALET,
Agents for the Applicants.

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